User's Manual

Plasma Monitoring
&
Control System

PlasCalc-2000-UV-VIS-NIR

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1 Safety Instructions

Instructions: All the safety and operating instructions should be read before the unit is operated. Before using the power supply for the first time check for transport damage.

Warning: All warnings on the unit and in the operating instructions should be adhered to.

Use this instrument in a clean laboratory environment.

Moisture
The unit is designed for operation in dry rooms only.

Heat
The unit should be situated away from radiators, hot bodies, ovens or other heat sources.

Power Sources
The unit should be connected to a power supply only of the type described in the operating instructions or as marked on the unit.

Object and Liquid Entry
Care should be taken that objects do not fall, or liquids spilled into the enclosure through openings.

2 Unpacking Instructions

Your package should contain:

1x PlasCalc-2000-UV-VIS-NIR
1x Power supply 12VDC
1x USB connection cable
1x Software CD
1x This manual

1 Unpack your PlasCalc-2000 carefully. Dropping this instrument can cause permanent damage.

2 Inspect the outside of the instrument and make sure that there is no damage to your unit. In case of damage contact the dealer immediately and DO NOT USE THE INSTRUMENT!

3 Introduction

Ocean Optics PlasCalc

Process control is essential in industrial plasma applications to ensure reliability and high quality of the process. For this purpose optical emission spectroscopy (OES) is an excellent tool since this technique does not affect the plasma and several plasma species can be monitored in real-time and in-situ.

The **Ocean Optics PlasCalc** system is designed especially for industrial applications where a robust set-up and an easy-to-use software are required. The **Ocean Optics PlasCalc** software is an easy-to-use Windows® software which can be run interactively for research purposes as well as stand-alone for process monitoring and controlling. The software can be configured for the use by technical personal.

Enjoy working with this powerful OES system.

Ocean Optics Germany GmbH

4 Installation

4.1 Installation

Do not connect the system to the PC before PlasCalc Software has been installed.

Insert the PlasCalc **CD** in your CD drive and launch the setup program. The setup program will lead you through the installation process. Please follow the instructions and fill in the necessary information.

All program files and the Java Runtime Engine will be copied on the hard disk of your computer. Please make sure that enough free disk space (approx. 100 MByte) is available.

4.2 Software Update

Disconnect the PlasCalc-2000 system from the PC before updating the software. Once the system is disconnected install the new version like first time installation.

4.3 Removing PlasCalc

For a complete removal of **PlasCalc** from your computer please activate the icon *Software* in the *System Panel* of Windows, select **PlasCalc** in the lower list box and then press the button *Add/Remove*. All program files of **PlasCalc** will be removed completely from your computer.

4.4 System Requirements

IBM compatible PC with Pentium processor or equivalent and CD drive

Operating system Windows 2000/XP/WIN7 (32bit)

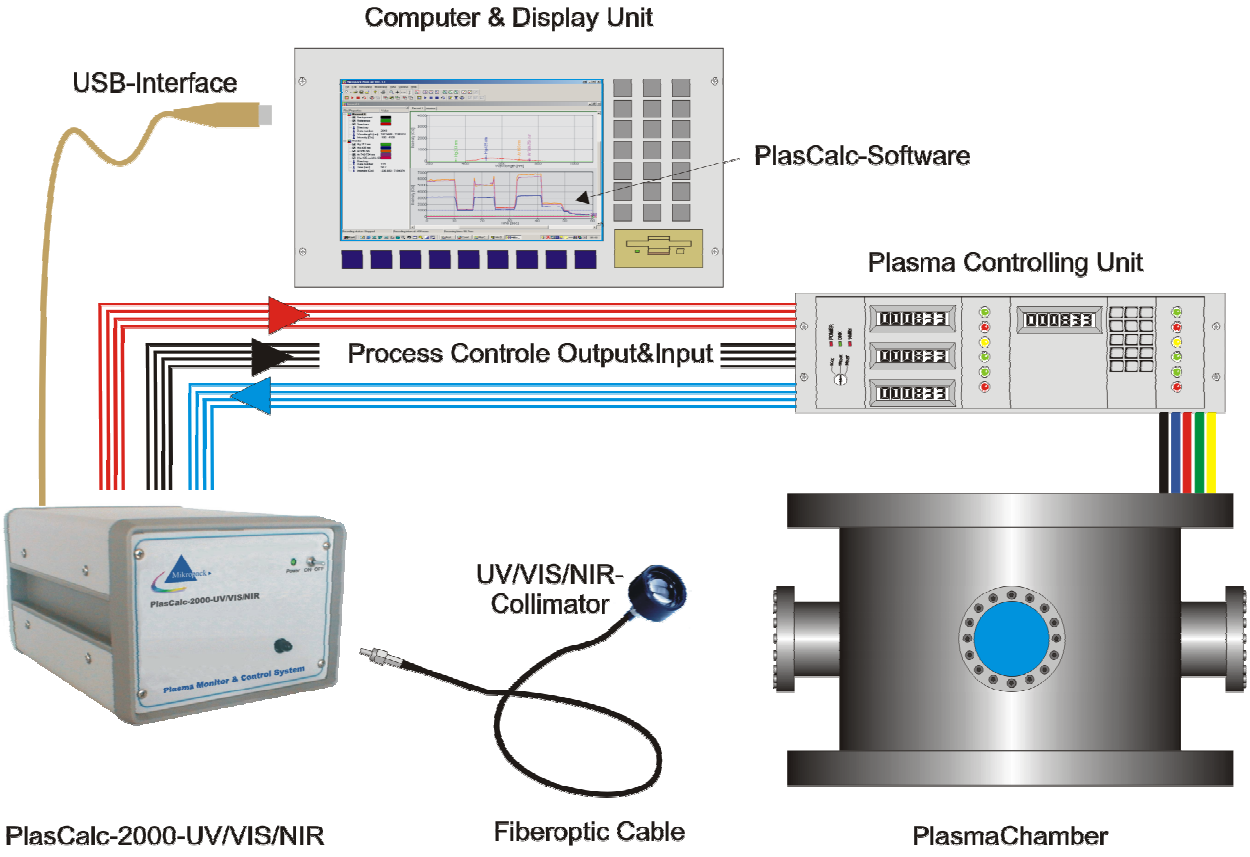
Required free hard disk space:

approx. 100 MByte

5 Description

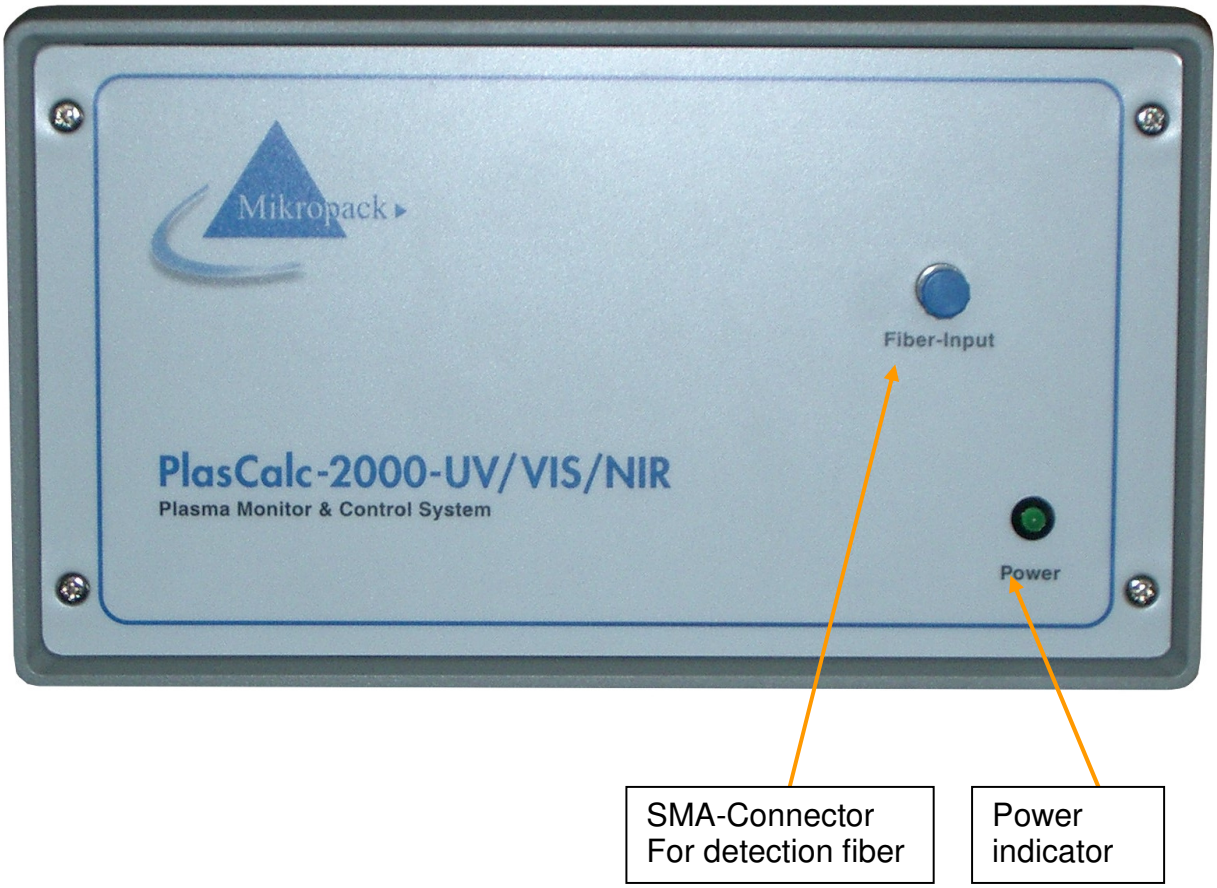
With its high resolution miniature fiberoptic spectrometer equipped with a 2048 pixel CCD and fast acquisition electronics, the PlasCalc acquires plasma light emission from 200 to 1100 nm in 3 ms. The well engineered PlasCalc process control system brings the benefits of sophisticated algorithms for data acquisition and signal treatment. The analog-digital output and input capabilities gives together with full PC connectivity all options to control the process.

System Setup:

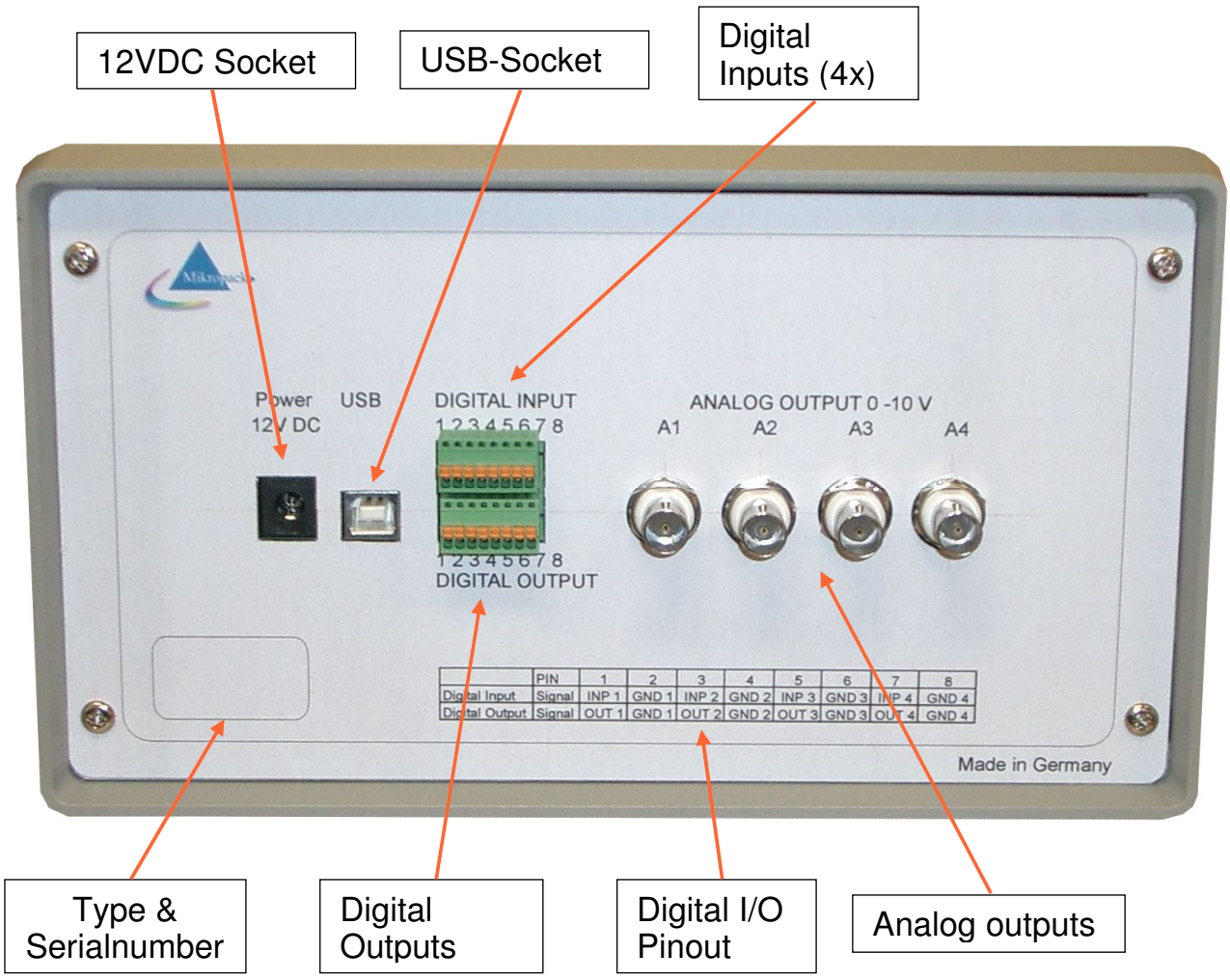


6 Functions of Panel controls

6.1 Front Panel



6.2 Back Panel


12VDC Socket
USB-Socket
Digital Inputs (4x)
Power 12V DC
USB
DIGITAL INPUT
1 2 3 4 5 6 7 8
ANALOG OUTPUT 0 -10 V
A1
A2
A3
A4
1 2 3 4 5 6 7 8
DIGITAL OUTPUT
PIN 1 2 3 4 5 6 7 8
Digital Input Signal INP 1 GND 1 INP 2 GND 2 INP 3 GND 3 INP 4 GND 4
Digital Output Signal OUT 1 GND 1 OUT 2 GND 2 OUT 3 GND 3 OUT 4 GND 4
Made in Germany
Type & Serialnumber
Digital Outputs
Digital I/O Pinout
Analog outputs

The digital inputs and outputs are differential I/Os. Therefore you need to connect a signal and a ground wire to each input and each output.

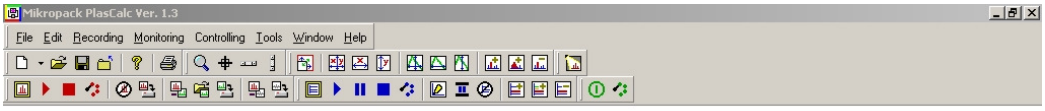
7 Software

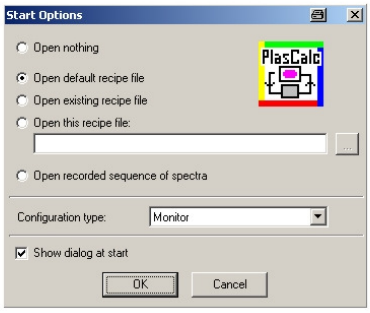
7.1 Installation

Connect the system to the PC only after the software has been installed.

1. Close all applications running on the PC
2. Insert the software CD into the CD-ROM drive
3. Run the "setup" executable to start the installation process
   - Click next on the welcome dialog
   - Read the license agreement carefully and click next if you accept it
   - Enter a user-name and your organization, choose who should be able to use the software and click next
   - Choose an installation path and click next
   - If the settings shown are correct click install
   - Click finish to exit the installation routine
   - Reboot the PC sot hat the new settings can take effect

7.2 Quickstart

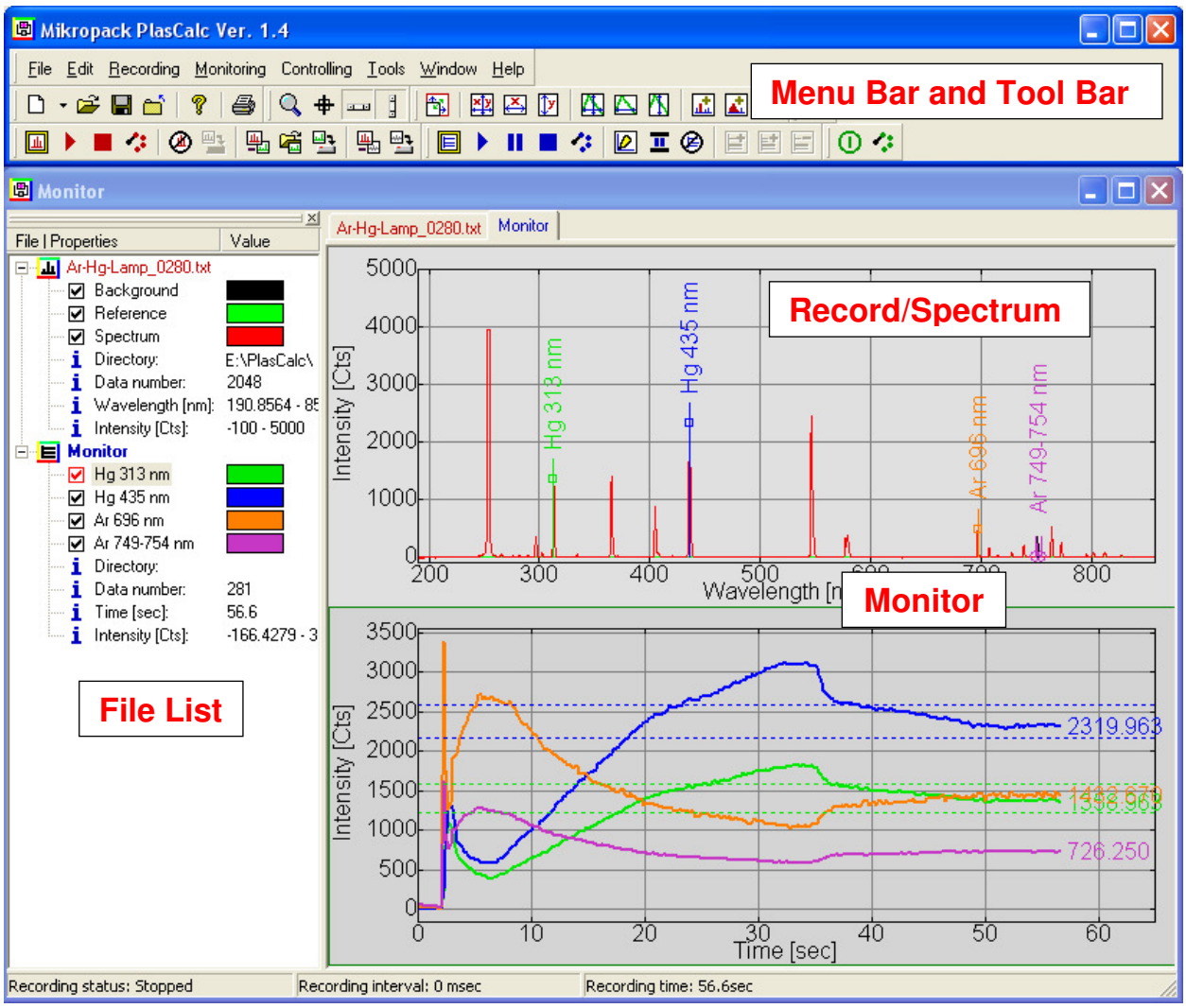




At the first start the following dialog will appear. To do the first measurements select "open default recipe" and click OK. The application window (Spectrum and Monitor window) will be loaded.
To start Recording spectra goto menu: Recording | Start recording.
To start Monitoring and Recording goto menu: Monitoring | Start monitoring

7.3 Application Windows

The application window of **Mikropack PlasCalc** is divided in the following windows:



Menu and tool bars:	main window with menu and tool bar commands
File list:	listing of all open files and tracks
Record/Spectrum:	window with currently recorded spectrum
Monitor:	window with monitor tracks

Menu and Tool Bars

This is the main window of the application which appears after starting the program. The menus and toolbars contain all commands available as it is common in Windows® applications.

File List

The file list is a summary of all open files with a listing of the tracks for each file. The check box in front of each track indicates whether a track is visible or hidden. The check box of the currently selected track is displayed in red and the background color of the track name corresponds to the system color for selections.

Pressing the right mouse button above a track or file name will open up a menu with commands available for that track or file.

Record/Spectrum Window

While recording this window displays the currently acquired spectrum as well as the background and reference spectrum. Lines and integrals are indicated and you may add, change or delete those lines and integrals for monitoring or evaluation purposes.

When evaluating spectral data you may open and superpose as many spectra as you like in this window.

Monitor Window

In the monitor window the time tracks of the intensities of selected lines and integrals are displayed. Tracks can be added by selecting a line or integral in the *Record/Spectrum* window and by carrying out the command *Add line/integral as monitor track*.

When evaluating monitor data a saved PlasCalc File (.pcf) is displayed in this window.

7.4 Menu Commands

7.4.1 File Menu

New ... <

Create one of the following configurations as new:

New record

New monitor

Open ...

Open a spectrum or an existing PlasCalc File (.pcf).

Save

Save the data of the active window in ASCII format. You will be asked which spectra or time tracks you want to save.

Close

Close the active window with all spectra and/or PlasCalc Files.

Print...

Print the active window. For the setting up the printer please refer to the options section in the printer set-up.

Start options ...

Open the dialog for changing the start options.

Operation mode <

Select the operation mode and configure the user mode

Administrator mode

User mode

User setting

Changing between administrator and user mode requires a password. The default password is "admin".

If you don't remember your password copy the default administration file "admin" from the installation CD in the program folder.

Exit

Close the application **Ocean Optics PlasCalc** stopping all recording processes.

7.4.2 Edit Menu

XY-Autoscale

Set the display ranges of the wavelength/time and of the signal to the minimum and maximum data values of the selected file.

This will display all data of the selected file.

X-Autoscale

Set the display range of the wavelength/time to the minimum and maximum data values of the selected file.

The display range of the signal remains unaffected.

Y-Autoscale

Set the display range of the signal to the minimum and maximum data values within the displayed wavelength/time range of the selected file.

The display range of the wavelength/time remains unaffected.

XY-Autoscale single track

Set the display ranges of the wavelength/time and of the signal to the minimum and maximum data values of the selected spectrum/track.

This will display all data of the selected track.

X-Autoscale single track

Set the display range of the wavelength/time to the minimum and maximum data values of the selected spectrum/track.

The display range of the signal remains unaffected.

Y-Autoscale single track

Set the display range of the signal to the minimum and maximum data values within the displayed wavelength/time range of the selected spectrum/track.

The display range of the wavelength/time remains unaffected.

Add line

Add a line to the selected spectrum.

This line may be used for monitoring the time dependency of the intensity.

Add integral

Add a line integral to the selected spectrum.

This line integral may be used for monitoring the time dependency of the intensity.

Delete line/integral

Delete selected line or line integral.

If this line or line integral was connected to a monitor track the corresponding monitor track will be deleted as well.

Configure plot ...

Open the dialog for setting up or changing the plot options.

7.4.3 Recording Menu

New record

Create a new record file.

Start recording

Start recording spectral data.

Stop recording

Stop recording spectral data.

Suspend record display

Suspend record display while recording data.

Since updating the display consumes a lot of CPU time this option may be helpful for measurements in which time is critical.

Configure recording

Open the dialog for setting up and changing the recording options.

Save current spectrum

Save the current spectrum while recording.

This button is only available if the *Save spectra on demand* option is selected in the Dialog *Record Options*. The file name for saving must also be specified in that dialog or in the dialog *Monitor Options*.

Recording mode | Spectrum mode

Switch to Spectrum mode. In this mode unprocessed spectra are shown

Recording mode | Transmission mode

Switch to transmission mode. In this mode transmission spectra are shown. Transmission is calculated using the actual spectrum and a reference and dark spectrum which have to be defined before.

Recording mode | Reflection mode

Switch to reflection mode. In this mode reflection spectra are shown. Reflection is calculated using the actual spectrum and a reference and dark spectrum which have to be defined before.

Recording mode | Absorption mode

Switch to absorption mode. In this mode absorption spectra re shown. Reflection is calculated using the actual spectrum and a reference and dark spectrum which have to be defined before.

Switching between the recording modes is only possible while recording and monitoring are stopped.

Reference spectrum | Subtract reference spectrum

Switch on/off automatic subtraction of reference spectrum while recording.

Reference spectrum | Take current spectrum as reference spectrum

Set current spectrum as reference spectrum.

Reference spectrum | Open reference spectrum from file

Load a reference spectrum from hard disk.

Reference spectrum | Save reference spectrum to file

If the saving option is selected in the dialog ***Record Options*** and default file name for the reference spectrum is specified, the current spectrum will also be saved to hard disk using the default file name.

Reference spectrum | Clear reference spectrum

Clear the reference spectrum. All signal values are set to zero.

Intensity calibration | Apply intensity calibration

Activate / deactivate intensity calibration

Intensity calibration | Take current spectrum as calibration spectrum

Set current spectrum as calibration spectrum.

Intensity calibration | Open calibration spectrum from file

Load an existing calibration spectrum from disk

Intensity calibration | Save calibration spectrum to file

Save the calibration spectrum do disk

Intensity calibration | Clear calibration spectrum

Clear the calibration spectrum. All values are set to zero.

Dark spectrum | Subtract dark spectrum

Switch on/off automatic subtraction of background spectrum while recording.

Dark spectrum | Take current spectrum as dark spectrum

Set current spectrum as background spectrum.

If the saving option is selected in the dialog *Record Options* and default file name for the background spectrum is specified, the current spectrum will also be saved to hard disk using the default file name.

Dark spectrum | Open dark spectrum from file
Load existing dark spectrum from disk

Dark spectrum | Save dark spectrum to file
Save the dark spectrum to disk.

Dark spectrum | Clear dark spectrum
Clear the background spectrum. All signal values are set to zero.

7.4.4 Monitoring Menu

New monitor
Create a new monitor file.

Start monitoring
Start monitoring.
If the option *Synchronize recording with monitoring* is selected in the dialog *Monitor Options* recording spectra will start as well.

Pause monitoring
Pause monitoring.
While pausing monitoring recording spectra will continue. Monitoring time is suspended until pausing is turned off.

Stop monitoring
Stop monitoring.
If the option *Synchronize recording with monitoring* is selected in the dialog *Monitor Options* recording will stop as well.

Suspend monitor display
Suspend monitor display while recording data.
Since updating the display consumes a lot of CPU time this option may be helpful for measurements in which time is critical.

Configure monitoring
Open the dialog for setting up and changing the recording options.

Fix plot at minimum x
Fixes the monitor plot at actual x value

Auto pause monitor
Pause monitoring automatically if monitor tracks are below given setpoint

Add line/integral as monitor track
Add selected line or line integral as monitor track.

Add combined monitor track
Add monitor track as a combination of two already existing monitor tracks.
The tracks can be combined by basic arithmetical operations.

Load monitor recipe
Open and load recipe file with monitoring options from hard disk.

Save monitor recipe
Save current monitoring options to recipe file on hard disk.

Delete monitor track
Removes the selected monitor track

7.4.5 Controlling Menu

Controlling | Controlling on/off
Switching control on and off

Controlling | Configure controlling
Open the dialog for setting up and changing the control parameters

7.4.6 Tools Menu

Spectrometer | Select spectrometer
Opens the dialog for selecting a spectrometer. In this dialog the Serialnumber of the PlasCalc system has to be selected

Spectrometer | Configure spectrometer
Opens a dialog to view and change calibration parameters of the spectrometer.

Control devices | Select control device
Select if the PlasCalc-2000 control device or a demo driver is used

Multi channel systems | Configure monitor
Only for multi channel systems like the ProCess-2000

SpecLine | Open spectrum
Opens the specLine software and shows the selected spectrum

SpecLine | Configure
Set the installation path of the SpecLine software

All SpecLine related functions are only functional if SpecLine is installed on the PC.

7.4.7 View Menu

View | Zoom
Switch on/off zooming.

View | Line cursor
Switch on/off line cursor.

View | Horizontal scrollbar
Switch on/off horizontal scroll bar.

View | Vertical scrollbar
Switch on/off vertical scroll bar.

View | File list
Display file list window.

View| Tool Bars <
Show/hide the following tool bars:

- File
- View
- Edit
- Recording
- Monitoring

7.4.8 Window Menu

All windows are listed and can be selected.

7.4.9 Help Menu

Help | **PlasCalc Help Index**
The index of the help system of von **Ocean Optics PlasCalc** is displayed.

Help | **Ocean Optics Homepage**
Link to **Ocean Optics** Homepage. Please check for news and latest updates.

Help | **About**
Information about **Ocean Optics PlasCalc** is displayed.

7.5 Tool Bars

In the tool bars the most important and often used menu commands are displayed as buttons. By pressing a button the corresponding menu command is carried out.

7.5.1 File Tool Bar

Button	Action
	Create a new record or monitor window
	Open an existing spectrum or PlasCalc File (.pcf)
	Save the data of the active window in ASCII format
	Close the active window with all spectra and/or PCF files
	Display the index of the help system
	Print the active window

7.5.2 View Tool Bar

Button	*Action*
	Switch on/off zooming
	Switch on/off line cursor
	Switch on/off horizontal scrollbar
	Switch on/off vertical scrollbar

7.5.3 Edit Tool Bar

Button	*Action*
	Open dialog for setting up and changing plot options
	Autoscale display ranges for x and y of the selected file
	Autoscale display range for x of the selected file
	Autoscale display range for y of the selected file
	Autoscale display ranges for x and y of the selected track
	Autoscale display range for x of the selected track
	Autoscale display range for y of the selected track
	Add a line to the selected spectrum
	Add a line integral to the selected spectrum
	Delete selected line or line integral

7.5.4 Tools Tool Bar

Button	*Action*
	Open current spectrum in SpecLine (available only if SpecLine is installed)

7.5.5 Recording Tool Bar

Button	*Action*
	Create a new record file
	Start recording spectral data
	Stop recording spectral data
	Suspend record display while recording data
	Save the current spectrum while recording
	Switch to spectrum mode
	Switch to transmission mode
	Switch to reflection mode
	Switch to absorption mode
	Switch on/off automatic subtraction of reference spectrum
	Load a reference spectrum from hard disk
	Set current spectrum as reference spectrum
	Switch on/off automatic background subtraction
	Close window with all files

7.5.6 Monitoring Tool Bar

Button	*Action*
	Create a new monitor file
	Start monitoring
	Pause monitoring
	Stop monitoring
	Open dialog for setting up and changing monitor options
	Switch on/off the fixing of monitor time scale at currently displayed minimum time
	Switch on/off automatic pausing of monitoring for low light intensity. The intensity threshold must be set in the dialog Monitor Options
	Suspend monitor display while recording data
	Add selected line or line integral as monitor track
	Add monitor track as a combination of two already existing monitor tracks
	Delete selected monitor track

7.5.7 Controlling Tool Bar

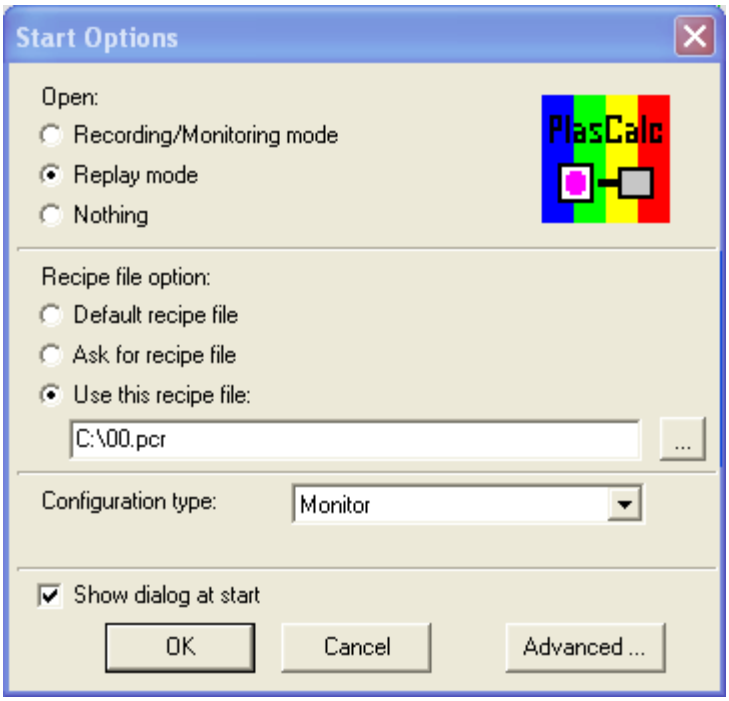
Button	*Action*
	Switch on/off controlling
	Open dialog for setting up and changing control parameters

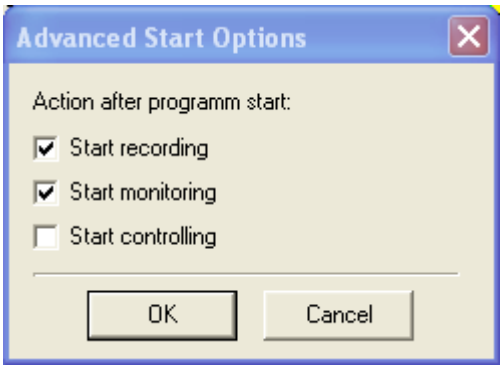
7.6 Dialogs

7.6.1 Start Options

Start Options

Dialog for setting and changing the start options:





Open nothing	Start main program only
Open default recipe file	Start and open default recipe file
Open existing recipe file	Start and ask for existing recipe file
Open this recipe file	Start and open given recipe file
Configuration type	Choose type of configuration: Record or Monitor
Show dialog at start	Show Start Options dialog at start of program

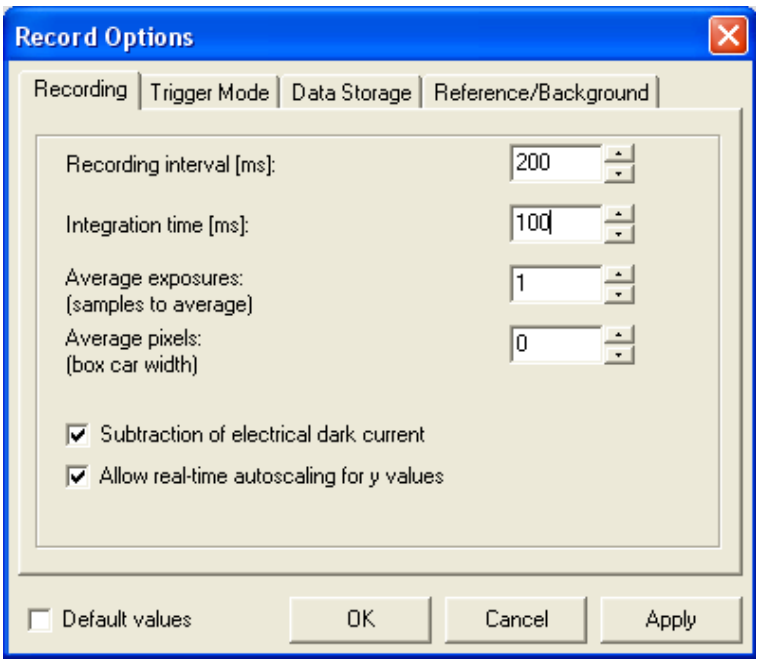
Advanced start options:

In the advanced start options you can select which options are started automatically when the software is started

7.6.2 Record Options

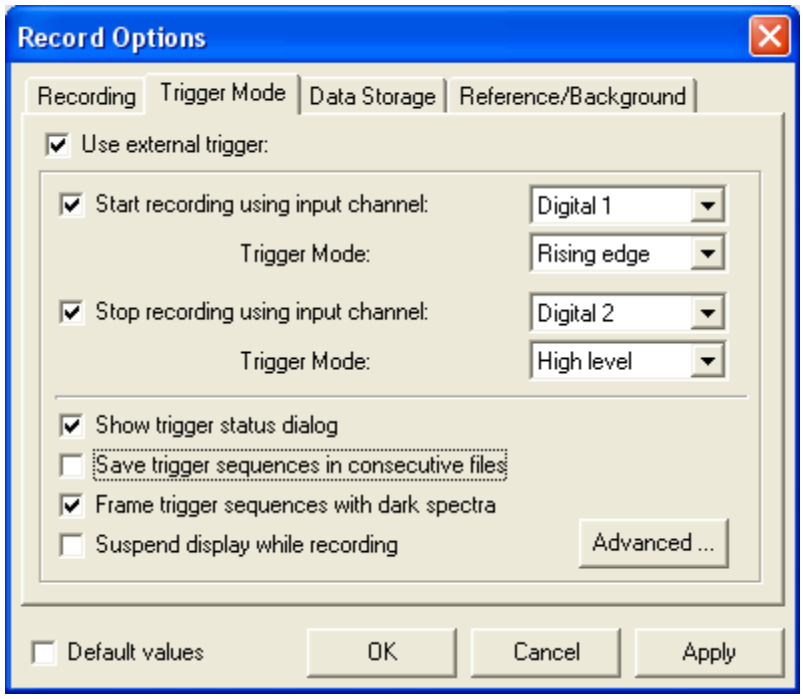
Dialog for setting and changing options for recording spectra with the following tab sheets:

Recording



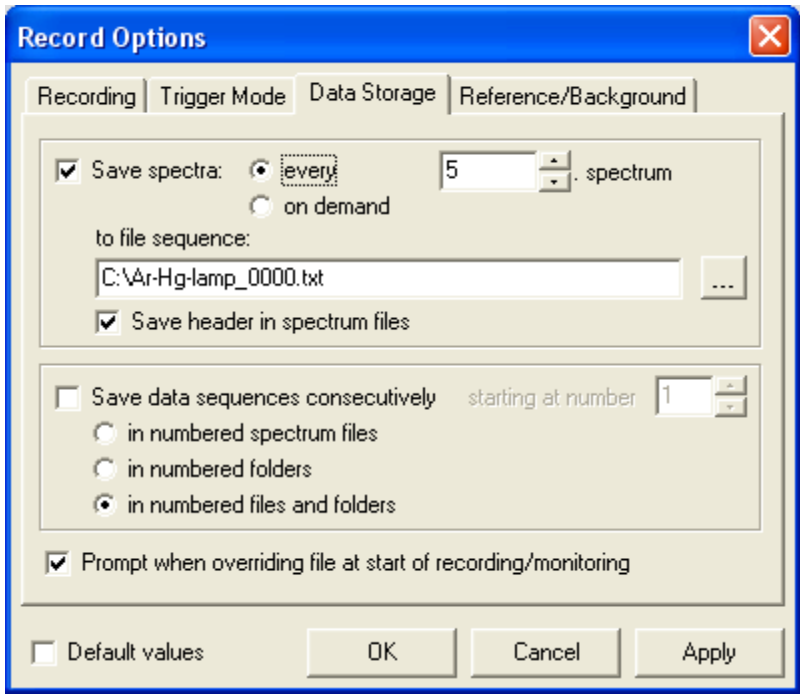
Recording interval	**Interval between consecutive exposures**
Integration time	**Integration time of single exposure**
Average exposures	**Average over the given number of exposures**
Average pixels	**Average over the given number of pixel (spectral mean average value, box car width)**
Subtraction of electrical dark current	**Automatic correction of electrical dark of the diode array**
Allow real-time autoscaling for y-values	**Automatic autoscaling of the y-values while monitoring. The autoscaling can be switched on and off with the commands Y-Autoscale and Y-Autoscale single track**

Trigger Mode



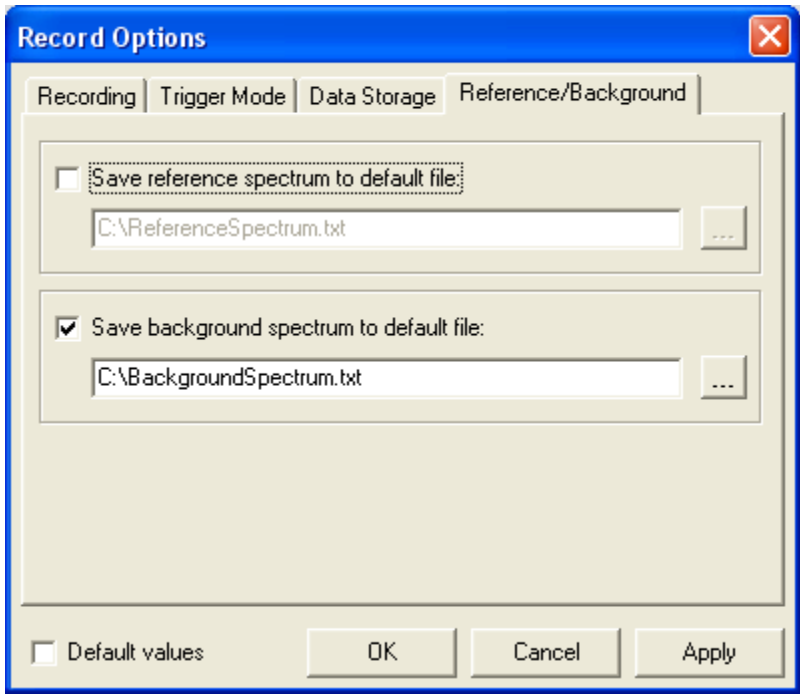
Use external trigger	***External trigger mode. Make sure that you can provide a TTL signal at the spectrometer***
Trigger delay	***Delay time after providing trigger signal***
Number of exposures after trigger	***After each trigger signal the given number of exposures is recorded***
Recording time after trigger	***Recording time after each trigger signal according to the recording interval and numbers of exposures***
Show trigger status dialog	***Display trigger status dialog while recording in external trigger mode***
Save trigger sequences in consecutive files	***The data of each trigger sequence is stored in consecutive numbered files instead of a single file***
Frame trigger sequences with dark spectra	***Each trigger sequence is displayed and stored with zero data at the beginning and end of sequence***
Suspend display while recording	***While recording the display is suspended. The data is displayed after each trigger sequence. Since updating the display consumes a lot of CPU time this option may be helpful for measurements in which time is critical***

Data Storage



Save spectra	***Save spectra to consecutive files on hard disk according to given settings. The file name will be extended by ongoing numbers!***
Save data sequences	***Each recorded process data is stored in consecutive files or consecutive folders with ongoing numbers***
Prompt when overriding file...	***Prompt when overriding files at the beginning of each recording sequence***

Reference Background

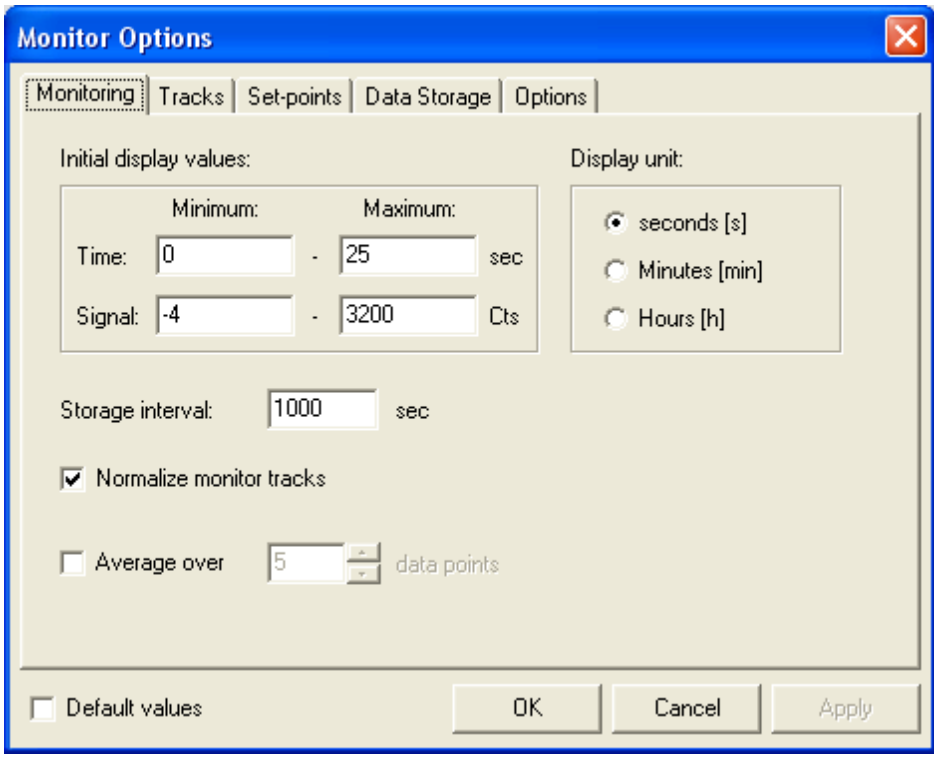


Save reference spectra	***Save reference spectrum by default in specified file on hard disk***
Save background spectra	***Save background spectrum by default in specified file on hard disk***
General:	
Default values	***The current options are saved as default values***

7.6.3 Monitor Options

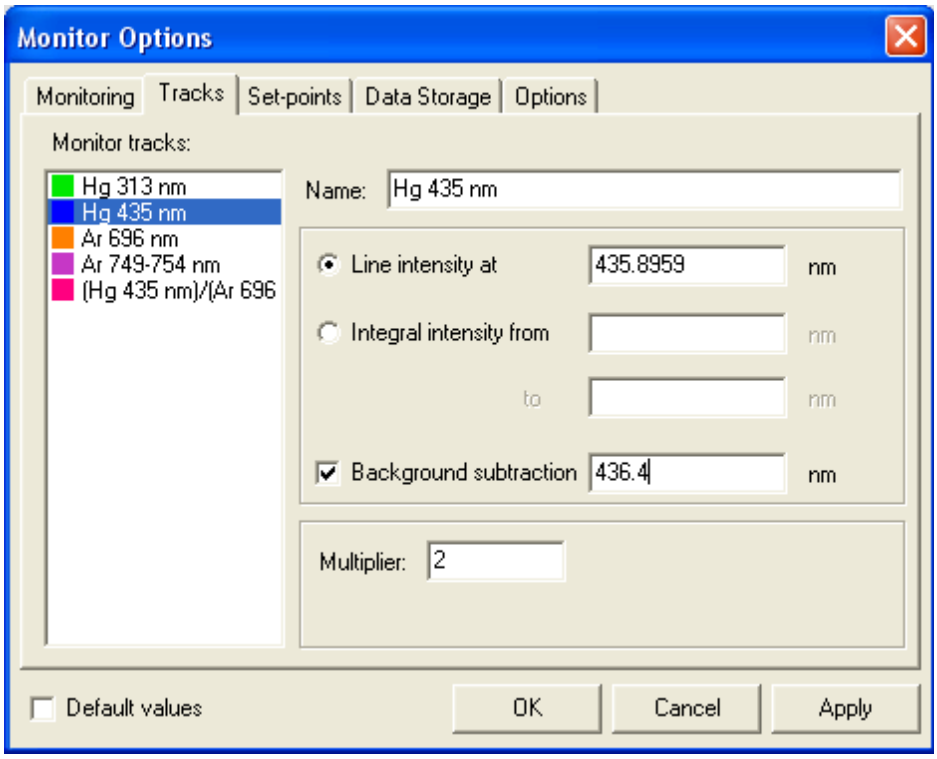
Dialog for setting and changing options for monitoring with the following tab sheets:

Monitoring



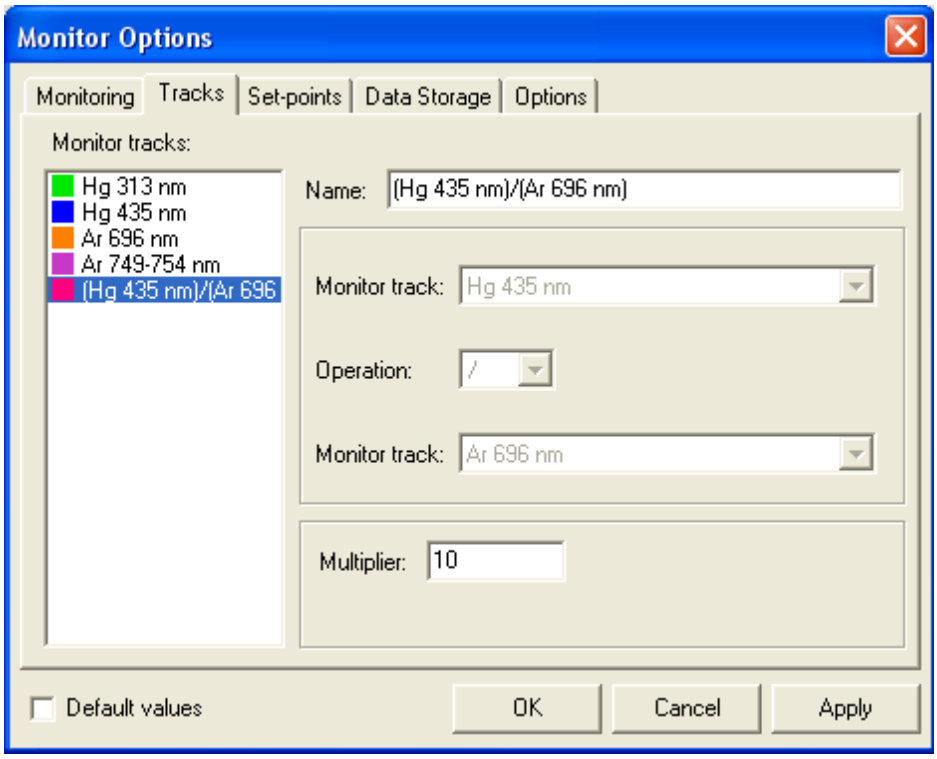
Initial display values	***Initial display interval of time and intensity***
Display unit	***Unit of time scale***
Storage interval	***Time interval for which recorded data is stored in RAM memory. Please be aware of available memory!***
Normalize monitor tracks	***All monitor signals are scaled to the maximum intensity value***
Average over ... data points	***Average over the given number of data points while monitoring***

Tracks (single track)



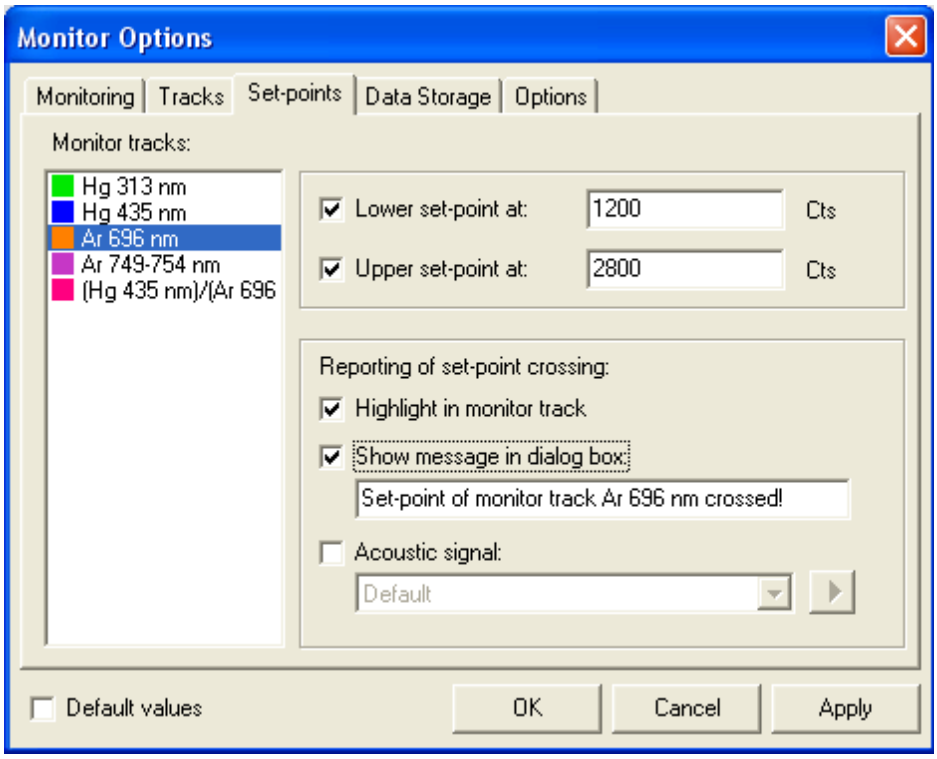
Monitor tracks	***Selection list of monitor tracks***
Name	***Description of monitor track***
Line intensity	***Evaluate line intensity at given wavelength value***
Integral intensity	***Evaluate intensity of line integral between given wavelength values***
Background subtraction	***Subtract background using intensity value at given wavelength***
Multiplier	***Multiply recorded intensity with the given value***

Tracks (combined track)



Monitor tracks	***Selection list of monitor tracks***
Name	***Description of monitor track***
Monitor track	***Selection list of first monitor track to be combined***
Operation	***Selection list of basic arithmetical operations***
Monitor track	***Selection list of second monitor track to be combined***
Multiplier	***Multiply recorded intensity with the given value***

Setpoints

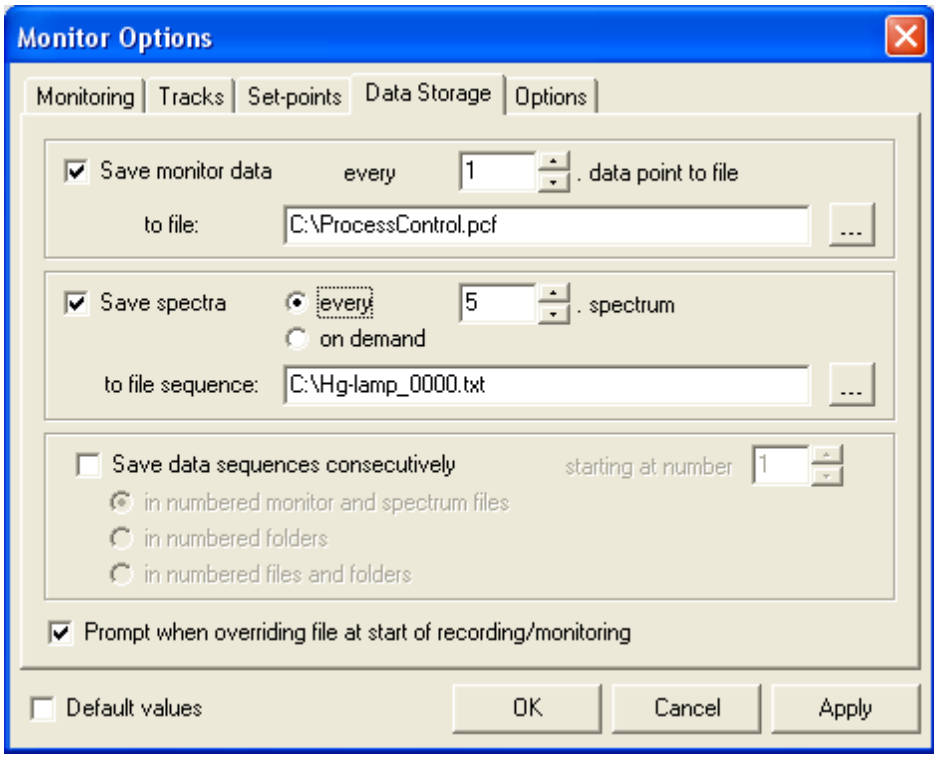


Upper set-point at	***Upper set-point at given intensity value***
Lower set-point at	***Lower set-point at given intensity value***

Recording of set-point crossing:

Highlight in monitor track	***A blinking symbol is shown on the display at the specified track when a set-point is crossed***
Show message in dialog box	***Show the below given text on the screen when a set-point of the track is crossed***
Acoustic signal	***Play the below given acoustic signal when a set-point of the track is crossed***

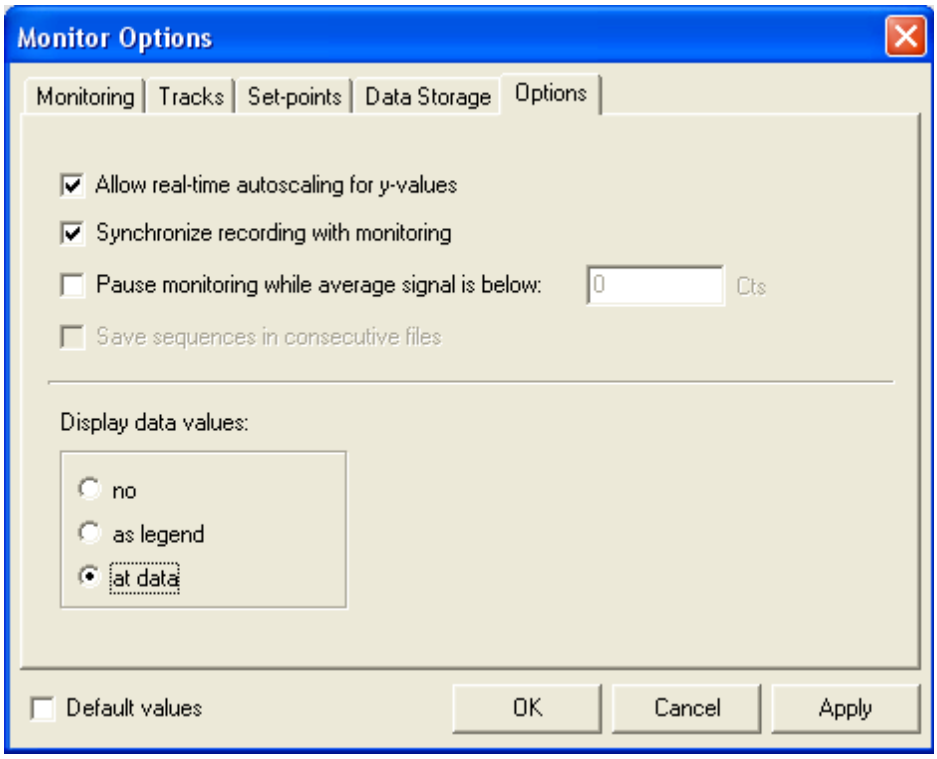
Data storage



Save data	***Save monitor data to file on hard disk according to given settings***
Save spectra	***Save spectra to file on hard disk according to given settings. The file name will be extended by ongoing numbers!***
Count data files	***Each recorded process data is stored in consecutive files with ongoing numbers***
Prompt when overriding file...	***Prompt when overriding files at the beginning of each recording sequence.***

These entries correspond to the setting in the dialog Record Options.

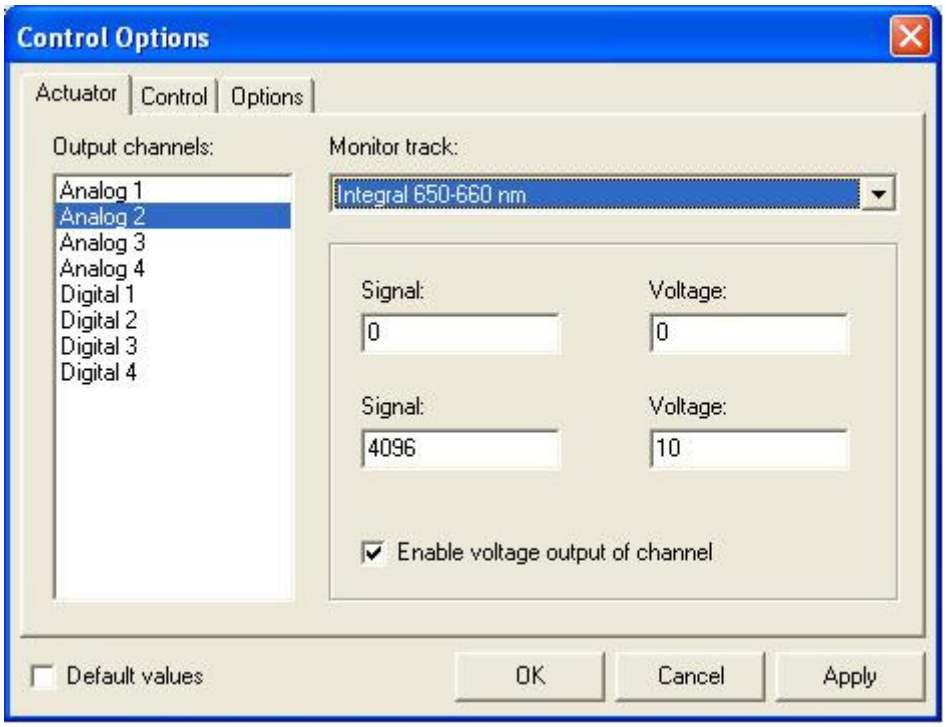
Options



Allow real-time autoscaling for y-values	Automatic autoscaling of the y-values while monitoring. The autoscaling can be switched on and off with the commands Y-Autoscale and Y-Autoscale single track.
Synchronize recording with monitoring	Synchronize Start/Stop of recording spectra with Start/Stop of monitoring
Pause monitoring while average signal...	Automatic pausing while monitoring for overall light signals less than the given value
Display data values	Display current intensity value while monitoring
Reporting of set-point crossing	Action when falling below or exceeding set-point
General:	
Default values:	The current options are saved as default values

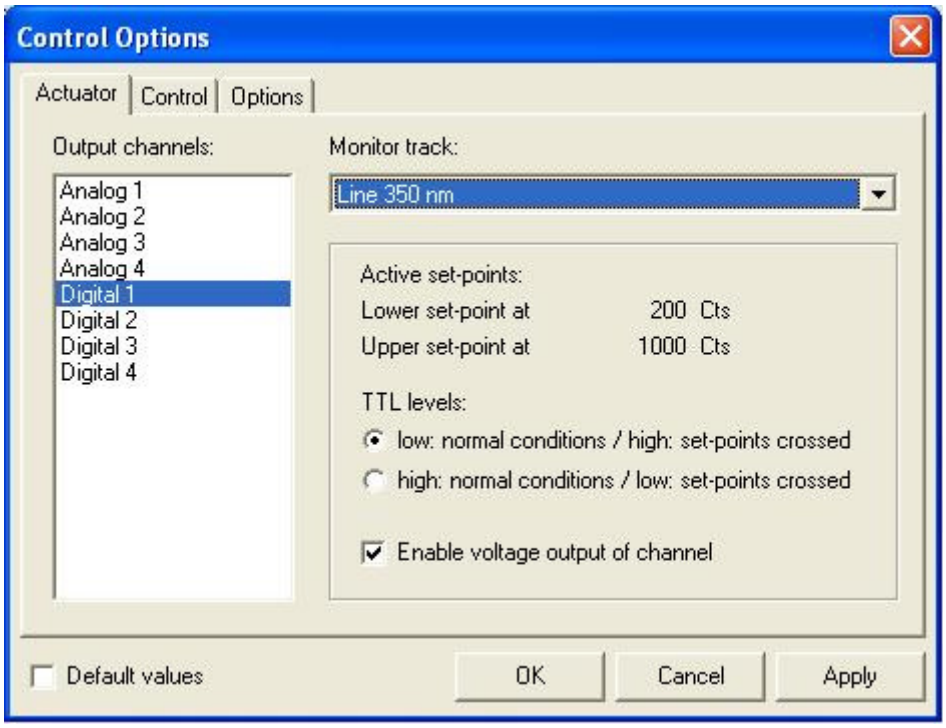
7.6.4 Control Options

Actuator (analog output)



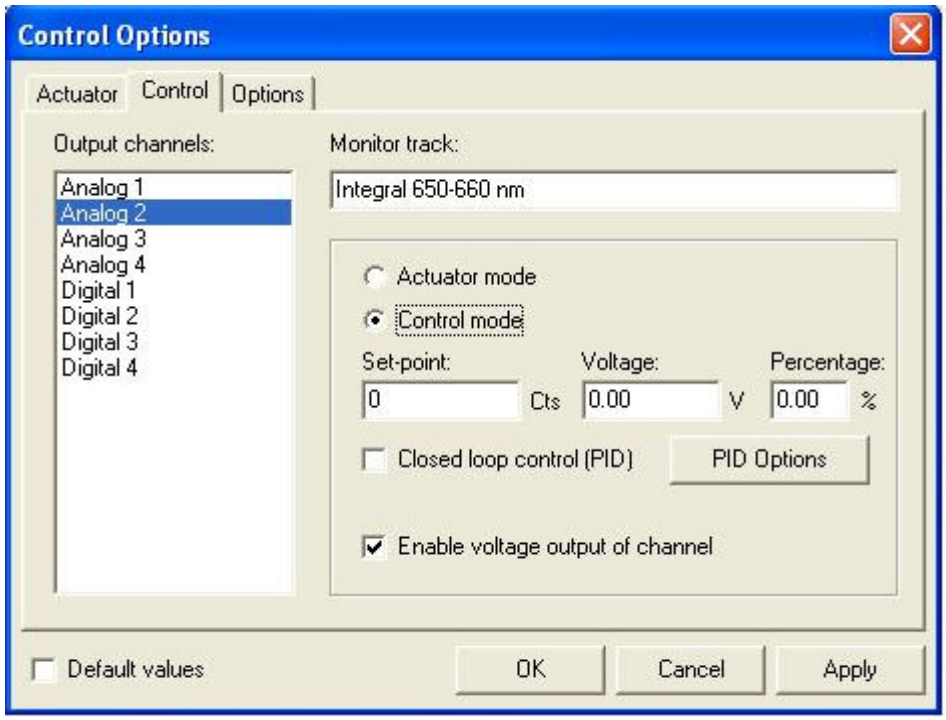
Output channels	Selection list of available output channels
Monitor track	Selection list of monitor tracks to be assigned to selected output channel
Signal	Signal values
Voltage	Voltage values to be assigned to signal values. The output voltage will be interpolated according to the given values
Enable voltage output of channel	Switch on/off voltage output for selected output channel

Actuator (digital output)



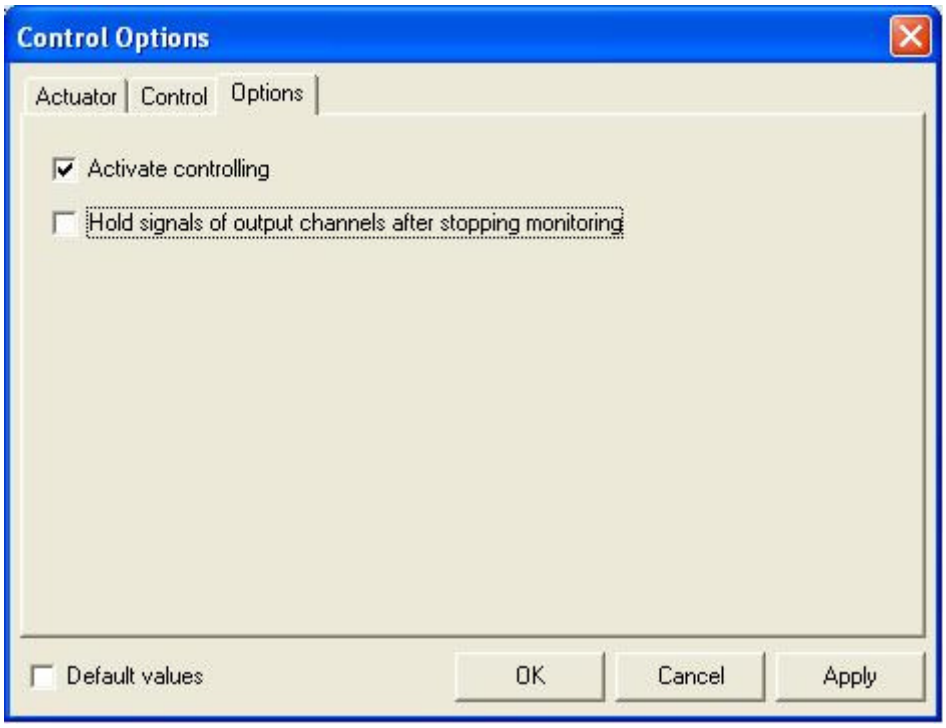
Activate controlling	Switch on/off controlling
Output channels	Selection list of available output channels
Monitor track	Selection list of monitor track to be assigned to selected output channel
Active set-points	List of active set-points with set-point values
TTL levels:	
low.../high:	normal TTL signaling
high.../low:	inverse TTL signaling
Enable voltage output of channel	Switch on/off voltage output for selected output channel

Control



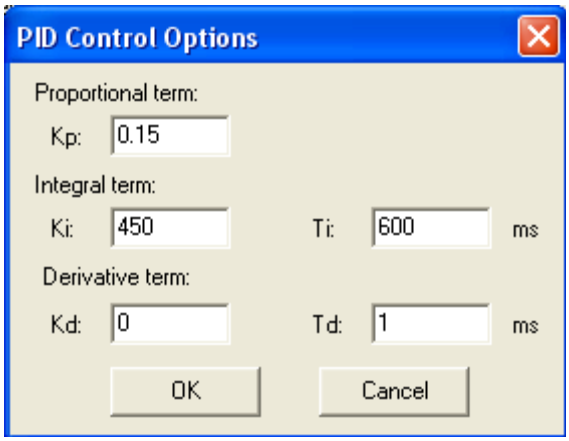
Output channels	Selection list of available output channels
Monitor track	Selection list of monitor track to be assigned to selected output channel
Active control loop	Switch on/off controlling for selected channel
Set-point / Voltage / Percentage	Set-point value for controlling given signal counts / output voltage / percent of maximum signal
Closed loop control (PID)	Switch on/off PID control
Enable voltage output of channel	Switch on/off voltage output for selected output channel

Options



Activate controlling	Switch on/off general controlling
Hold signals of output channels after ...	The voltage of the analog outputs and the TTL levels of the digital outputs is hold or set to zero when the monitoring is stopped
General:	
Standard values	The current options are saved as default values

PID Control Options



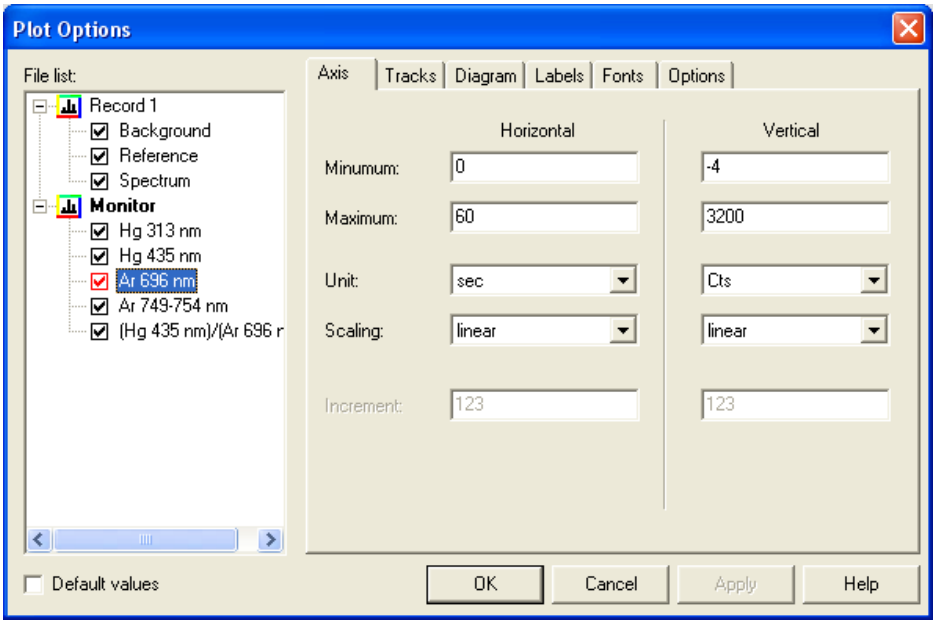
Proportional term	Kp parameter
Integral term	Ki and Ti parameter
Derivative term	Kd and Td parameter

7.6.5 Plot Options

Dialog for setting and changing plot options with the following tab sheets:

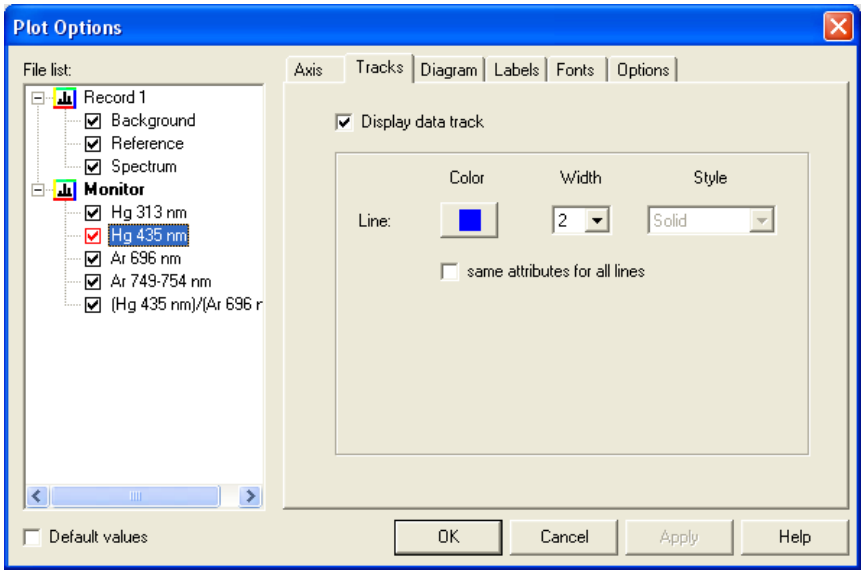
General:

File list	Selection list of files and tracks



Axis

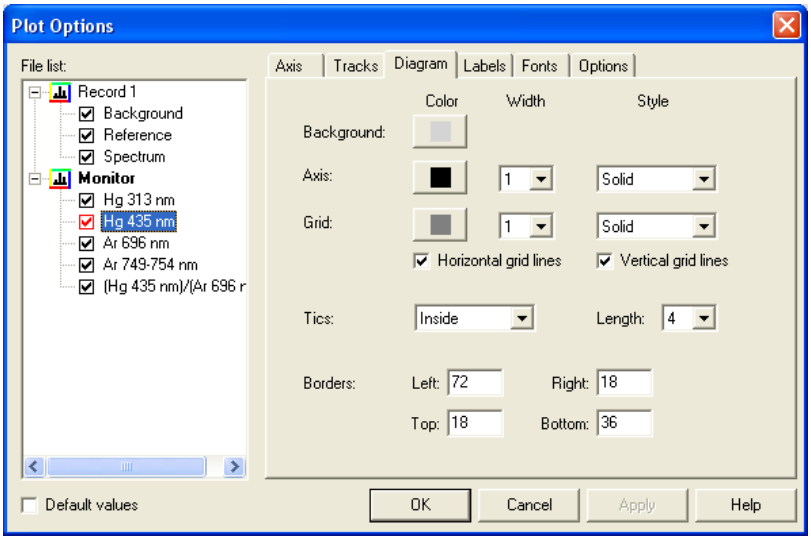
Minimum	Smallest display value
Maximum	Largest display value
Unit	Unit of axis
Scaling	Scaling method of display
Increment	Reserved



Tracks

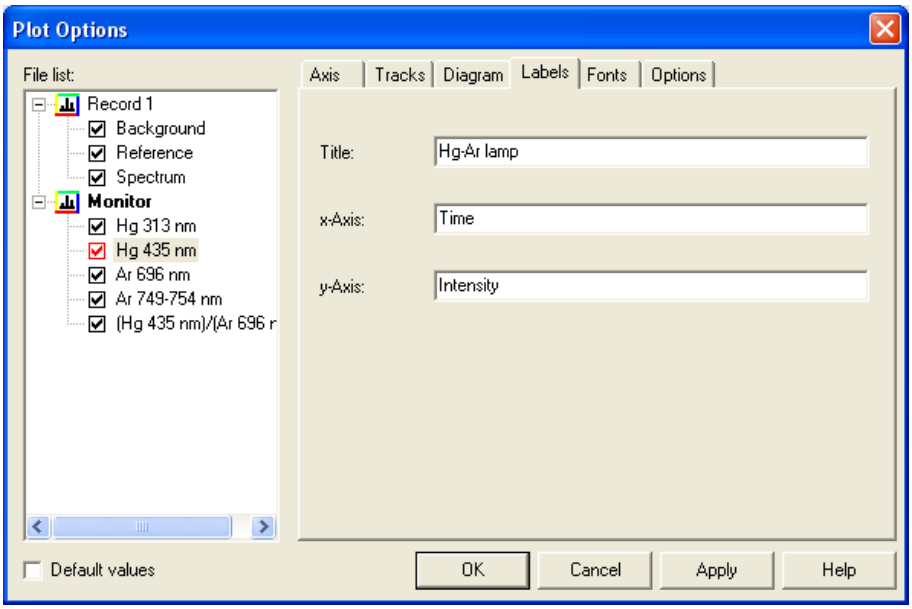
Display track	Display track in diagram
Line	Line options of selected track: color, width and style
same attributes for all lines	Line options are applied to all tracks

Diagram



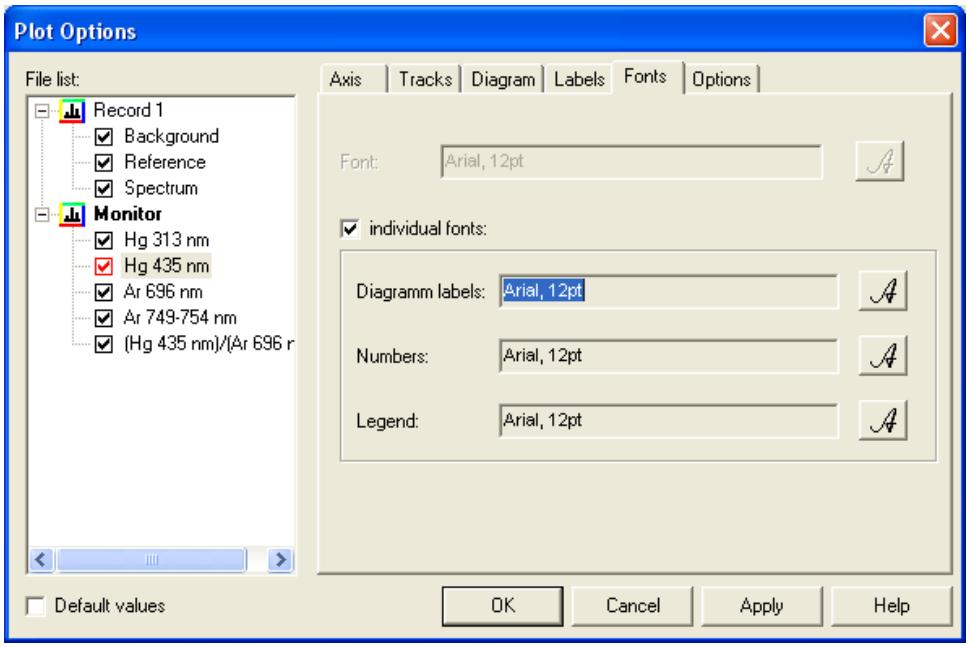
Background	Background color
Axis	Line options of axis: color, width and style
Grid	Line options of grid: color, width and style
Horizontal grid lines	Display horizontal grid lines
Vertical grid lines	Display vertical grid lines
Tics	Position and Length of unit tics
Borders	Border width of diagram

Labels



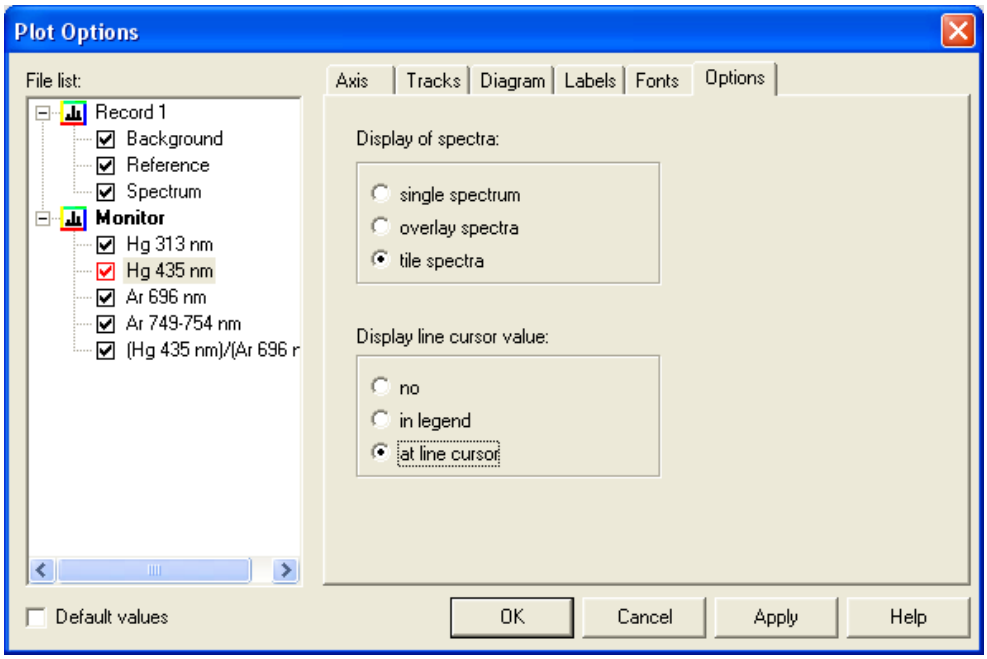
Title	Title of diagram
x-Axis	Label of x-axis
y-Axis	Label of y-axis

Fonts



Font	General font
Individual fonts	Individual fonts
Diagram labels	font of diagram labels
Numbers	font of numbers
Legend	font of legend

Options



Display of spectra
- single spectrum
- overlay spectra
- tile spectra

Display open files as
- single
- superposed
- tiled horizontally

Display line cursor value
- no
- in legend
- at line cursor

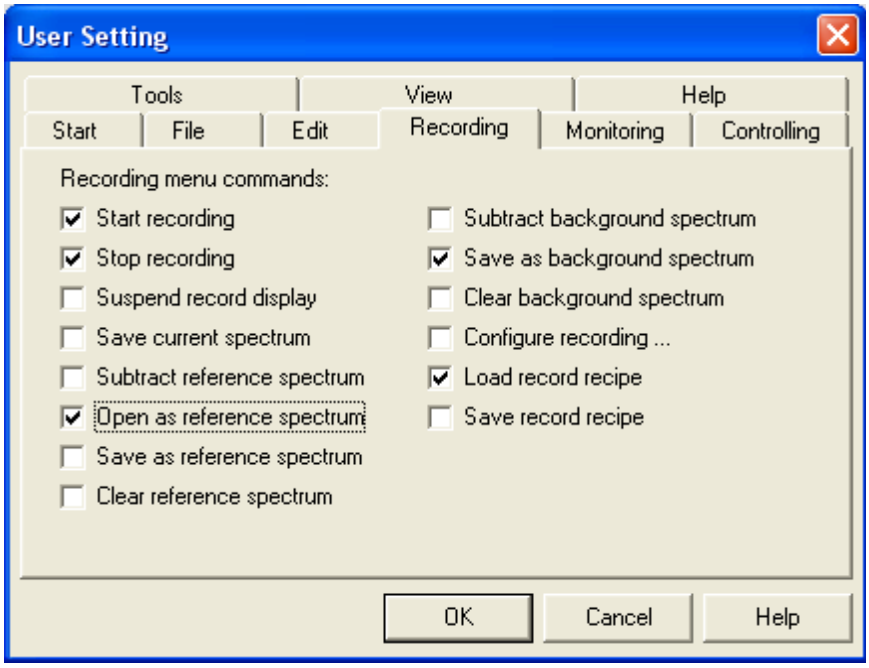
Display line cursor
- no display
- value is displayed in legend
- value is displayed at line cursor

General:

Standard values: The current options are saved as default values

7.6.6 User Setting

Dialog for the configuration of the user mode setting.



All menu commands are listed as in the menus. The selected commands are enabled in user mode, all others are disabled.

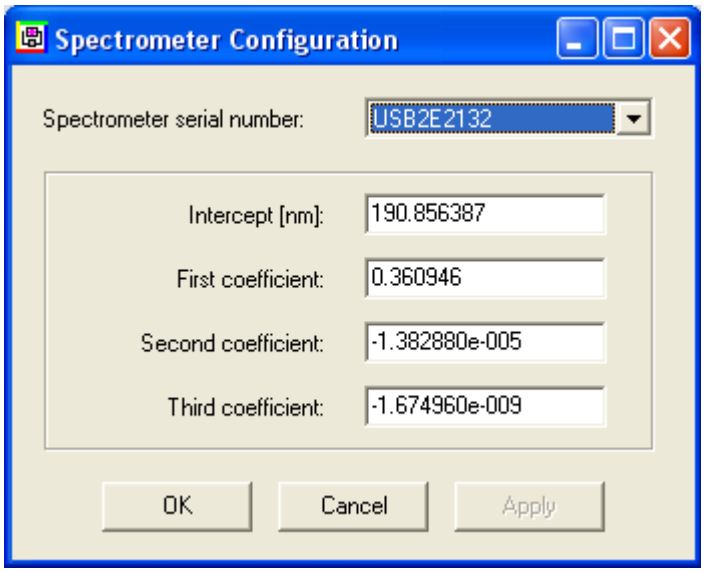
Notice:

Changing between administrator and user mode requires a password. The default password is "admin".

If you don't remember your password copy the default administration file "admin" from the installation CD in the program folder.

7.6.7 Spectrometer Configuration

Dialog for changing the spectrometer configuration.

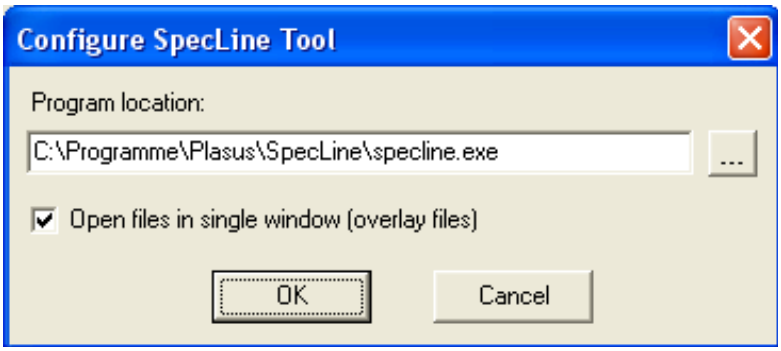


Serial number	Serial number of the connected spectrometer
Wavelength calibration:	
Intercept	Intercept wavelength of regression fit
First coefficient	First coefficient of regression fit
Second coefficient	Second coefficient of regression fit
Third coefficient	Third coefficient of regression fit

Warning: These settings should only be changed by experienced users

7.6.8 Configure SpecLine Tool

Dialog for configuring the optional software-tool SpecLine



Program location	Directory and file name of executable file of SpecLine
Open files in single window	In SpecLine the spectra are opened in a single (Overlay mode) or in seperate windows

8 Specifications

Technical Data	PlasCalc-2000-UV/VIS/NIR
Spectral range	200-1100 nm
Optical resolution	1 nm FWHM (full width half maximum)
Fiber-input-connector	SMA905
D/A-converter	14 bit
Analog output /voltage sign.	4 x [0-10V]
Digital input/output	4 x TTL / 4 x TTL
Interface	USB V1.1
Power supply	12VDC 1,25A
Operating temp. / humidity	5-35°C / 5-95% without condensation
Dimensions	257 x 152 x 263 mm
Weight	3,9 kg

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10 Appendix A

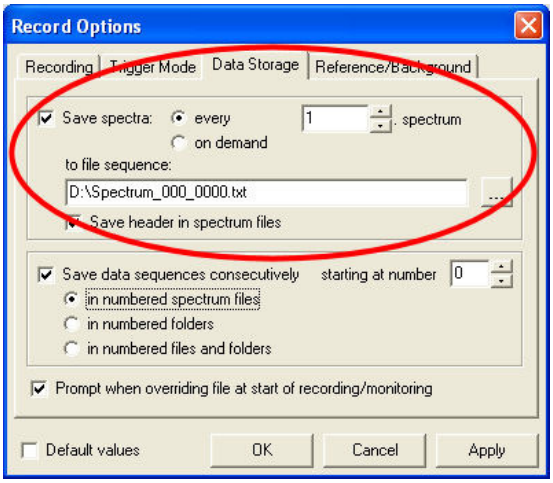
10.1 Endpoint detection with the PlasCalc system

General remarks

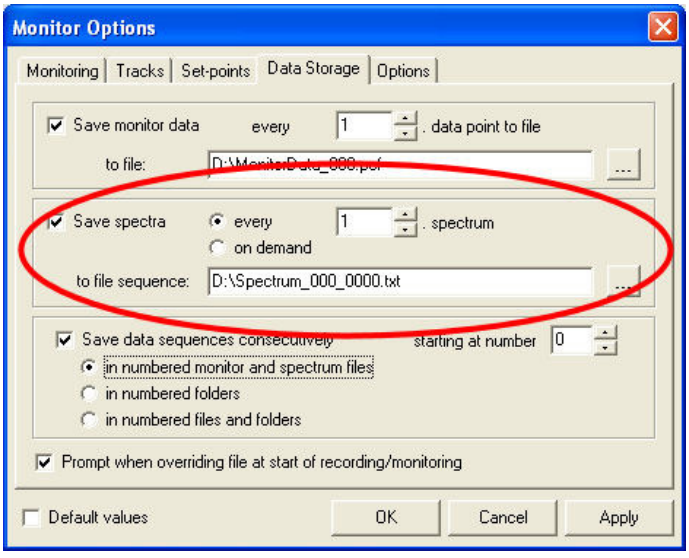
In the following a step-by-step instruction is presented for setting up an endpoint detection recipe for the *OCEAN OPTICS* PlasCalc system. In the following it is assumed that you are familiar with the basic functions of the *OCEAN OPTICS* PlasCalc system.

A. First time data acquisition

While a typical process cycle is running, acquire spectra from the plasma. Save all recorded spectra on your PC (hard disk) by selecting this option either in the *Record Option* dialog



or in the *Monitor Option* dialog:



Important: During the process cycle please write down the number of the spectra which are recorded before and after the endpoint.

B. Identification of process relevant plasma particles

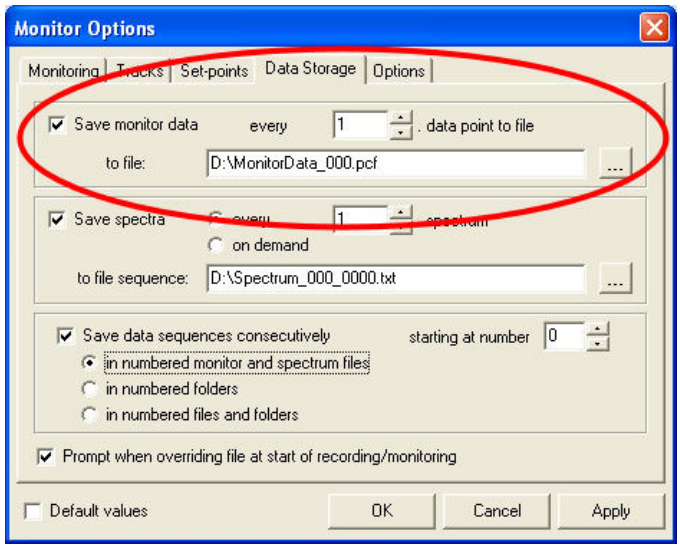
From the recorded data select at least two spectra one before and one after the endpoint was reached. Carry out an identification of process relevant plasma particles using e.g. ***SpecLine*** software. Search especially for atomic lines and molecular bands of the process gas, of the layer material and of the substrate material.

Compare the two spectra and look for new or vanished lines and difference in line intensities.

C. Setting up and recording monitor tracks

From the evaluated spectra write down the wavelength of the lines, which have changed while crossing the endpoint. Create monitor tracks for these lines and name the tracks according to the name of the identified plasma particle. Save your settings in a monitor recipe file using the menu command: *Monitoring* | *Save monitor recipe*!

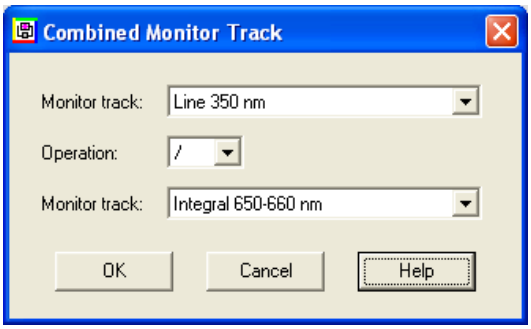
Run the plasma process again and this time, also save the monitor data by selecting the option in the *Monitor Option* dialog:



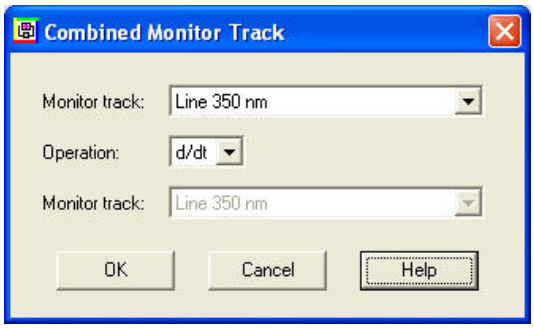
When crossing the endpoint you should notice a change in the monitor tracks. This may be an increase or decrease of signal of the monitor tracks.

Hint: Identifying the correct spectral lines and monitor tracks for endpoint detection is the most important and crucial task in this procedure. Please take your time and if you don't see immediately a correlation between the selected monitor tracks and the endpoint, create different monitor tracks from other lines of the recorded spectra and try again as suggested below.

If a correlation of the monitor signals and the endpoint is not directly seen, you may improve your monitor recipe by following one or more of the steps given below:

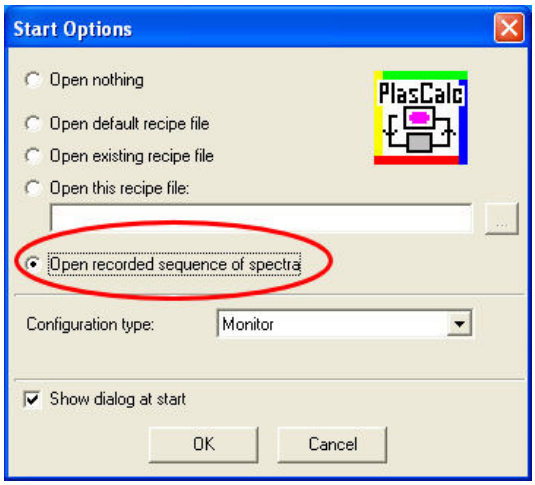
1. Create monitor tracks which are related (divided) to the monitor signal of the background gas (preferable a noble gas) using the menu command *Monitoring | Add combined monitor track*:
2. 

3. Create a monitor tracks which is Combining (dividing) monitor signals with different dependencies across the endpoint to improve the signal/noise ratio.
4. Create a monitor track with the derivative of a monitor signal if the temporal evolution is changing across the endpoint:



Important: After you have successfully determined appropriate monitor signals for detecting the endpoint, make sure that you save your settings in a monitor recipe using the menu command *Monitoring | Save monitor recipe*!

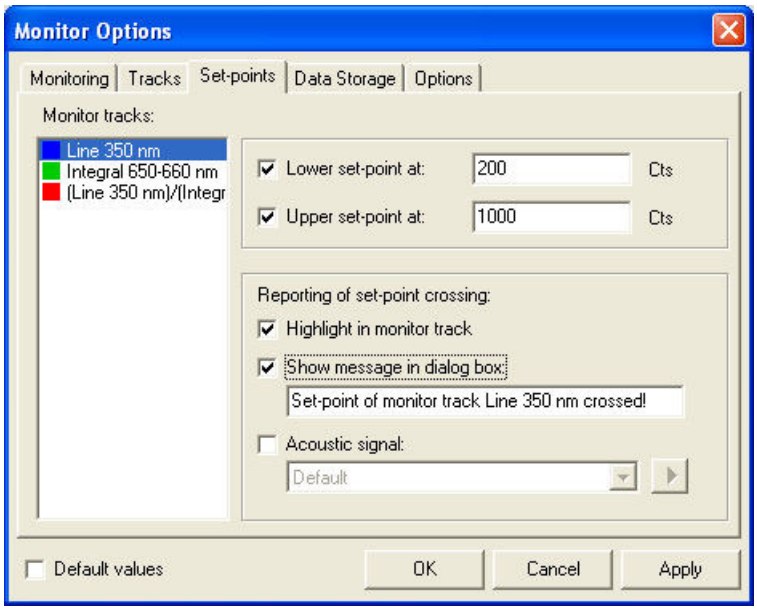
If it is not possible to run the process easily several times you may use the recorded spectra of the first run for defining the monitor tracks: When starting the PlasCalc software choose the option *Open recorded sequence of spectra* in the *Start Options* dialog:



In the *Open File* dialog specify the first recorded spectra. The recorded sequence of spectra acts like a movie and will be played in the *Record Window* in an endless loop. You can use all functions of the PlasCalc software as if you were doing a real-time recording. Proceed with the evaluation of monitor tracks as described above.

D. Defining set-points

Once you have set-up your monitor tracks and you can see a increase or decrease in the signal while crossing the endpoint you may define set-points for automatic signaling if the endpoint is reached. In the *Monitor Option* dialog activate lower and/or upper set-point for the monitor tracks of interest:



Specify how the crossing of a set-point is displayed on the screen and/or signaled by an acoustic sound.

The set-points are displayed in monitor window as dashed lines which can be moved using the mouse pointer.